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The Influence of Factory Life on the Health of the Operative, as founded upon the Medical Statistics of this Class at Belfast. By
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[Read before the Statistical Section of the British Association at Glasgow,
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THE great importance of the linen manufacture as the chief item in Irish prosperity, is a fact admitted by all. It is remarkable that but thirty years ago, this branch of trade was almost exclusively a rural occupation. The spinning wheel of the Ulster cottier gave place to the spindle about the year 1828, when the first flax spinning factory was erected by an Englishman in the neighbourhood of Belfast. Since that period, upwards of 25 mills, numbering about 237,000 spindles, and employing above 11,000 persons, have been in operation. Belfast is, therefore, essentially a factory-town. This manufacture has become an established necessity in our present exalted position as the chief business town in Ireland; and the prosperity of the country is now bound up with the progress of this ancient staple manufacture. It is, then, the duty of all who would wish to see Ireland preserve her powers of competition to use every legitimate means to foster this important branch of industry, and to endeavour to remove all impediments to its successful prosecution. Amongst these impediments, there is one which has attained much public prominence since the year 1830; namely, the alleged injurious influence of factory labour when compared with the discarded process of hand-spinning. The change to the use of machinery was forced upon Ireland when she resolved to retain her position in the linen manufacture. This revolution, it was maintained, was attended with enormous evils in a sanitary point of view, and an agitation which shook these countries to their centre was the result. Parliamentary commissions, in addition to innumerable volunteers, probed the evils alleged; and ultimately the Imperial Legislature interfered to limit the hours of labour, and legalized other restrictions upon the free use of factory labour. The Government and the country were alike convinced of the necessity for these stringent measures; and so judiciously have they been carried into operation, that even employers have admitted the utility of their provision.

It is not my intention to touch upon the question of Government interference with free labour. My object is simply to draw attention to the influence of factory life as founded upon medical statistics; to show that there are injurious results to a great extent necessarily due to factory employment, and to lay down some suggestions as recommendations to employers, for reducing the sphere of these influences to the smallest possible compass; and that this may be effected without a corresponding loss of industrial gain, it will be my province to show that the proposed improvements must be attended with positive profit.

In order that my audience may fully comprehend the exact amount and nature of the employment in flax spinning factories, I shall here premise a brief description of the processes through which the flax passes from the rough state to the yarn. It may be as well

to mention also one or two points in reference to the structure of the flax itself. The fibres of the flax, technically *liber fibres*, have been examined both microscopically and chemically, and are found to present peculiar characters.

"The filaments of flax," says Dr. Ure, "have a glassy lustre when viewed by daylight, in a good microscope, and a cylindrical form which is very rarely flattened; their diameter is about the 2000th part of an inch; they break transversely with a smooth surface like a tube of glass cut with a file; they are readily distinguished from cotton by their form and consistence, being round and attenuated to a point at each end, and of a firm woody consistence, which prevents them from collapsing and having pits in their walls." It would be also noticed, by reference to these drawings, that at intervals along the line of fibre there are opaque nodulated spots, presenting in some degree the appearance of joints. The difference between the flax fibre and the cotton down (the hair upon the seed of the cotton plant), and wool, which is but animal hair, is easily and at once determined by microscopical examination. Many chemical analyses of flax straw have been made since one of the earliest by Sir Robert Kane. One of the latest is from the laboratory of my friend, Professor Hodges, of Belfast, which is published in the transactions of the "British Association" for 1852; the result of the analysis will be found at page 276, from which I find the interesting fact, that a large amount (12·8 per cent.) of the ash of the straw is composed of the insoluble and infusible silica, which exists nearly pure in rock crystal, flint, and some kinds of sand, and, as is well known, is the chief ingredient in glass.

The bearing of these facts I shall reserve till after the description of the spinning processes, which I shall now submit. These processes are conducted in large factories by the aid of certain mechanical appliances, moved generally by steam power, and tended by a large staff of workers from ten years of age and upwards. The first process, called hackling, is effected by means of the hackling machine, the object of which is to split and fine the fibre. The kind of machine in ordinary use requires eight boys to attend it, generally the youngest hands in the mill. Their labour consists in screwing on and off the holder tops, about 4lbs. to 5lbs. weight, taking out the flax and placing it in a pile before them. This labour is unremitting, and is all performed standing. Several of these machines are at work in one room, the air of which, though of the ordinary temperature, is so charged with floating flax dust as slightly to obscure the vision. The hackled flax is now carried to the spreader, a machine on which the "stricks" of flax are spread by two girls upon four leather sheets or endless belts, which conduct the flax to two feeding and holding rollers; after passing through these, it is drawn by a pair of drawing rollers in front of the machine as in the cotton process, but with this difference, that in flax preparing machines "gills" are made use of, that is, bars armed with steel pins, which move in an endless chain by means of screws between the holding and drawing rollers. The object of the gills, is to assist in the holding and drawing of the fibre. The hands for this machine are the best paid in the mill, as more skill is required. They never change their place, but stand in

a slightly stooping position, and spread the flax as the sheet slowly revolves. As the flax leaves the "spreader" it resembles a ribbon, and is coiled for convenience in a tall can. Several of these cans are placed behind the next machine, called the drawing frame, and the flax ribbons are doubled and drawn out by it in the same way as in the spreading process. One girl will attend to the cans at the back of three drawing frames, and at the same time to the cans in front. She has to remove the cans as they are filled, and replace them; this work is light and intermittent, and allows of much freedom of movement. The flax ribbon is then passed through the second and third drawing frames in succession, with one girl to three, precisely as before. The ribbon as it leaves the drawing frame, "sliver," as it is called, is next submitted to the roving frame; the object of this machine is to draw the fibres still more, slightly twist and wind them preparatory to the last process. The "sliver" is put to the back of the roving machine in the can, and is thence drawn in as in the drawing frames.

On leaving the drawing rollers it receives a slight twist by the flyer in order to give it tenacity, and is then wound upon bobbins. One girl is employed at the back of the frame with the same duties as at the drawing frame, and another is employed in the front to shift the bobbins when full. The work in this room, which contains all the preparing machines, is light, and allows the girl often to sit; there is little dust, and the temperature is at par.

The flax is now ready for the spinning frame: this machine is provided with troughs filled with water kept heated to about 200° by steam. Through this the rove passes; afterwards through a pair of retaining rollers and a pair of drawing rollers; these draw out and attenuate the rove in its soft state; at the same time a spindle gives it the twist, and winds it upon the bobbin. One girl attends to each frame: her duty is to replace the roving bobbins as they become empty, and to piece the yarn when it breaks. She is assisted by a staff of young workers, called "doffers," eleven or twelve in each room, who, as each frame of bobbins becomes full, take them off, and replace them by empty ones. The room in which this process is conducted is generally very large, containing from fifty frames and upwards. The atmosphere is moist and hot, but free from all dust: the temperature seldom under 90°.

The full bobbins are next taken to the reeling rooms, and then reeled by grown up women on the reel frame. This work is not laborious, and admits of a constant change of position. The reeling-room is generally free from dust, and of an equal, moderate temperature.

In some factories a carding machine is employed for working up the coarser, shorter, and less valuable fibre, the refuse of the hackling process, technically called "tow." This is carded by the machine mentioned, and afterwards passes through the first and second drawing frames, and is then rove and spun precisely as the flax, and with the same number of hands. In the carding process, the tow is spread on endless sheets in front of the machine, by a girl, and then passes all round the card, transferred by rollers from one to the other until it comes out in *sliver*, or ribbon-shaped band, and

is deposited in the cans whence it is removed to the drawing frame. The carding work is constant, while the machine is in motion, and must be performed in a stooping position over the tow, which, in the process, so fills the air with the dust of the fibre, as to prevent clear vision: the temperature in this room is average.

The foregoing brief description is sufficient to show the nature of the injurious influences which are capable of inducing ill health in the operative: to these I shall severally allude, with a view to arrive at *à priori* results, which will prepare us for comparison with those actually ascertained by observation.

1st. *The influence of the Flax and Tow dust.*—All authors on the factory question, concur in ascribing much ill-health, if not actual disease, to the atmosphere of the hackling and carding rooms. In fact, a single visit to these departments, in operation, will convince the most sceptical that the functions of the organs of respiration must be materially and injuriously interfered with—for, of what is this dust composed? I refer now, particularly to the most minute particles, which indeed may be termed microscopic, inasmuch as the grosser portions of the fibre are evidently unable to reach the internal respiratory passages. The minute dust, then, consists, as I have before stated, of pointed, angular, slightly nodulated fibres, armed with minute portions of *silica*. It is self-evident, that if such particles and fibres reach the internal respiratory passages, they must act as foreign bodies, and set up more or less irritation. That they *must* enter the passages aforesaid is undoubted, as the particles spoken of are microscopic in magnitude. Should the operative be but for a limited time exposed to this influence, the irritation set up will right itself by eventual expectoration of the offending substance. But when this influence continues to operate for a lengthened period, it is plain that the irritation must become chronic, and the morbid changes resulting, will sooner or later assume the character of organic disease.

2nd. *The Position of the Worker.*—In all the processes, the chief position of the body is erect; in several, with a stooping inclination. At the drawing and roving frames, the work is intermittent, and permits in some degree of alternate rest. The immediate effects of posture are most marked in the young or growing. We are, accordingly, prepared to hear of complaints referable to the ankle or instep, which in certain constitutions would form a predisposing cause of articular disease. Again, the forward inclination of the body, a posture common to many occupations, has been long ascertained to tend to, if not actually *induce*, thoracic and gastric maladies. A moment's reflection on the constraint produced by this posture in the play of the respiratory and circulatory organs, as also the undue pressure on the abdominal viscera, the result of persistence in this posture, is sufficient to show its capability of interfering injuriously with the vital processes.

3rd. *High Temperature.*—In the spinning rooms, the air is not only very warm, but charged with vapour. The consequence is, that the workers are constantly and sensibly perspiring; and the feet, and a portion of their dress are saturated with the spray from the machinery. But this is not all. We must remember that there is

no change of dress, and that the transition from a high temperature and moist atmosphere, to a comparatively cold and dry one, is instantaneous, as the workers leave the mill three times a day without change of clothes, and with the skin in a high state of over-action. The causes at work here are, accordingly, the high temperature, the wet clothes, and the sudden transition from a heated to a cool atmosphere. All of these influences must bear more or less injuriously upon the respiratory organs. We are hence prepared to meet with *catarrhs*, *thoracic inflammations*, and even *pulmonary consumption*. It is true, as I have heard frequently remarked, that "the cold" which may be contracted from the transition referred to, has been actually cured by the return of the worker to the spinning-rooms; but it is evident, that what is capable of producing one attack, if repeatedly renewed, must in the end predispose to, if not, *per se*, induce actual disease. The violent stimulation of the skin which a high temperature produces, has also other effects. The circulation is rendered more active; and if there should be, as frequently does exist, a delicacy in any organ which may not have yet become developed into disease, there can be no question that the circumstances favourable to its development are here supplied. The high temperature is also unfavourable to the due action of the digestive organs. During digestion, the stomach in particular requires a large share of nervous energy exclusively for itself; if, therefore, the nervous energy be diverted to other purposes, as for example—to counteract the stimulating effect of a heated atmosphere, it is rational to believe that injury must result.

I have not alluded to the influence of fatigue, though it has been prominently referred to by writers on this question, because the hours of labour are now so reduced, that little or no complaint can be made on the score of over-work. Accordingly, I shall not here adduce it as an *à priori* evil.

I shall now submit the actual results which I have ascertained by statistical inquiry, as to the influence of factory life.

In Belfast, judging from the census returns of 1841 and 1851, and the ratio of increase, there are now about 112,000 inhabitants. Of these, judging from the same returns, about 36,000 belong to the operative class; *i. e.* persons not having the direction of labour. Of this latter number, about 11,000 are factory-workers, which, it will be observed, is a little less than one-third of the entire labouring population. By a calculation, based upon the actual numbers in several of our principal mills, I find that the number of hands in the hackling department, is 1899; in the preparing department, 1210; in the spinning department, 4351; in the reeling department, 2194; mechanics and bundlers, 1045; mechanics at odd work, 888. These figures show that we have a sufficiently extensive means of arriving at fair conclusions regarding the average amount of health, and tendency to disease, amongst this particular class. Upon this broad basis, I have arranged three systems of tabular returns, viz.:—

1. I examined 2078 female workers, by means of certain queries, indicating the particular employment, the age, the time at mill-work, the condition of health, and, as far as could be ascertained, the medical history, including the number of times laid up on account

of ill-health, the duration of past serious illnesses, and, as far as possible, the nature of the illnesses themselves. 2. I collected our general hospital returns, for some ten years past, in order to ascertain the relative number of factory workers, and the diseases for which they were admitted into hospital. 3. I collected similar returns from the registers of the six dispensary districts into which Belfast is divided, and ascertained in like manner the diseases for which they were treated. In addition to my own experience in my public appointment, which have for several years past furnished me with abundant opportunities, I personally inspected the workers at the factories, with a view to gain a general idea of their health status. The results of these different kinds of evidence I afterwards compared with the returns of disease amongst the entire population for whom medical relief has been provided by hospitals and dispensaries, *i. e.* amongst that section of society of which the factory operatives form a part.

1. The 2078 workers, to whom the queries were submitted, were indiscriminately visited at their homes, which were situated in various parts of the town, where, in fact, mill-workers mostly congregate. I found their ages to give the following result:—

| | |
|---------------------|-------------------------|
| Under 20 | 1,226 or 59·0 per cent. |
| From 20 to 30 | 745 or 35·8 ,, |
| From 30 to 40 | 89 or 4·2 ,, |
| Above 40 | 18 or 0·9 ,, |

Their particular departments of occupation I found to be as follows:—

| | |
|-----------------|-----------------------|
| Preparers | 262 or 12·6 per cent. |
| Spinners..... | 1,281 or 61·6 ,, |
| Reelers | 457 or 22·0 ,, |
| Weavers | 78 or 3·7 ,, |

The time during which they had been occupied at mill-work, is indicated by the following table:—

| | |
|--------------------------------|-----------------------|
| Under 1 year..... | 333 or 16·0 per cent. |
| Above 1 and under 5 years.... | 1,035 or 49·8 ,, |
| Above 5 and under 10 years.... | 512 or 24·6 ,, |
| Above 10 years | 198 or 9·5 ,, |

I found the following to represent the general average health;— the number in good health, or not complaining, 1522, or 73·2 per cent.; the number in tolerable health, who complained more or less constantly, 218, or 10·4 per cent. The number decidedly delicate, and requiring medical aid, 338, or 16·2 per cent. The number who admitted having been once laid up, 122; several times, 410; very often, 84; the remainder 1462, denied having ever left the mill in consequence of ill-health. The duration of the time in which workers were laid up on account of ill-health, is shown in the following table:—

| | | | |
|---------------------------|-----|-------------------------|-----|
| For 1 week or under | 200 | For 1 to 2 months | 149 |
| ,, 1 to 4 weeks | 192 | Above 2 months | 75 |

The total number who admitted having been off duty on account of ill-health, was 616, or 29·6 per cent. the amount of disease which they admitted they suffered, and for which they had to leave work, as shown in the following tables:—

Preparers.

| | |
|-------------------------------------|-----------------------|
| <i>Ages</i> —Under 20 | 132 or 50·4 per cent. |
| 20 to 30 | 110 or 42·0 „ |
| 30 to 40 | 15 or 5·7 „ |
| Above 40 | 5 or 1·9 „ |
| <i>Diseases</i> —Of the chest | 32 or 12·2 per cent. |
| Fevers..... | 11·4 „ |
| Headaches | 25 or 9·5 „ |
| Of the locomotive organs | 15 or 5·7 „ |
| Debility | 12 or 4·6 „ |
| Of the stomach and liver | 12 or 4·6 „ |
| Of the bowels | 9 or 3·4 „ |
| Of the skin | 9 or 3·4 „ |
| Injuries | 5 or 1·9 „ |

Spinners.

| | |
|----------------------------------|-----------------------|
| <i>Ages</i> —Under 20 | 920 or 71·8 per cent. |
| From 20 to 30 | 333 or 25·9 „ |
| From 30 to 40 | 28 or 2·1 „ |
| Above 40..... | None |
| <i>Diseases</i> —Headaches | 110 or 8·5 per cent. |
| Fevers | 94 or 7·3 „ |
| Stomach and liver | 81 or 6·3 „ |
| Locomotive organs..... | 72 or 5·6 „ |
| Chest | 53 or 4·1 „ |
| Debility | 43 or 3·3 „ |
| Nervousness | 33 or 2·5 „ |
| Injuries | 22 or 1·7 „ |
| Bowels..... | 16 or 1·2 „ |
| Of the skin | 8 or 0·6 „ |

Reelers.

| | |
|-------------------------------|-----------------------|
| <i>Ages</i> —Under 20 | 125 or 27·3 per cent. |
| 20 to 30 | 276 or 60·9 „ |
| 30 to 40 | 45 or 9·8 „ |
| Above 40 | 11 or 2·0 „ |
| <i>Diseases</i> —Fevers | 48 or 10·5 per cent. |
| Chest | 41 or 0·9 „ |
| Of the stomach and liver..... | 33 or 7·2 „ |
| Headaches | 30 or 6·5 „ |
| Debility | 27 or 0·6 „ |
| Bowels..... | 21 or 4·5 „ |
| Locomotive organs | 20 or 4·3 „ |
| Of the skin | 9 or 0·2 „ |
| Nervousness | 8 or 1·7 „ |

Weavers.

| | |
|-------------------------------|----------------------|
| <i>Ages</i> —Under 20 | 46 or 59·0 per cent. |
| 20 to 30 | 31 or 39·7 „ |
| 30 to 40 | 1 or 1·2 „ |
| Above 40 | None |
| <i>Diseases</i> —Fevers | 6 or 7·7 per cent. |
| Headaches | 5 or 6·3 „ |
| Debility | 4 or 5·0 „ |
| Stomach | 4 or 5·0 „ |
| Locomotive organs | 2 or 2·5 „ |
| Chest | 1 |
| Bowels..... | 1 |

The foregoing returns cannot be taken without some explanation. They are not intended to show either the actual or relative amount of disease suffered by the 2078 workers examined; but they do indicate the most important and most frequent kinds of ailment which made an impression upon the memory, and they are calculated to show distinctly enough the classes of complaints to which the mill-worker is more particularly subject. No hacklers are included in these returns, as that department is carried on by male hands. We have, then, only to compare the spinners with the "preparers and reelers." Among the spinners we find, as we should expect, headaches, and gastric ailments, and complaints of the extremities predominate. Among the preparers, we find headaches coming third in frequency, locomotive organs fourth, and gastric affections fifth; and among the reelers, gastric affections come third, headaches fourth, and locomotive organs sixth. With regard to thoracic diseases, we find a much smaller proportion than we should expect, amongst the spinners; the elder workers in the other departments having been much more frequently affected.

2. From the 1st of April, 1848, to the 1st of August, 1854, there were admitted into the general hospital 230 male, and 377 female workers, making a total of 607. Of this number, we find the following proportions referable to each class of affections:—

| | Males. | | Females. | | Total. |
|---|--------|-------|----------|-------|----------------|
| Injuries | 100 | ..... | 94 | ..... | 31·9 per cent. |
| Of the skin | 29 | ..... | 139 | ..... | 22·8 „ |
| Of the chest | 32 | ..... | 50 | ..... | 13·5 „ |
| Phthisis | 6 | ..... | 27 | ..... | 5·4 „ |
| Locomotive organs | 33 | ..... | 38 | ..... | 11·7 „ |
| Bowels | 10 | ..... | 9 | ..... | 3·1 „ |
| Dropsy, Uterine Disease, Nervousness, and Gastric Ailments, each under 2 per cent. | | | | | |

By comparing this set of figures with the returns of all the cases admitted into hospital for a period of several years, we find the following differences:—

Diseases of skin showed an increase of the general average to the amount of 6·3 per cent.

Injuries, 3·2 per cent.

Of the chest, a decrease of 3·6 per cent.

Of Phthisis, an increase of 3 per cent.

Of the locomotive organs, an increase of one-half per cent.

Of Uterine disease, an increase of 3·10 per cent.

Of the bowels, a decrease of 2 per cent.

Of Nervousness, an increase of 3·10 per cent.

Of Gastric affections, a decrease of 5 per cent.

Of Dropsy, a decrease of nearly 2 per cent.

We find accordingly that injuries, diseases of skin, of the locomotive organs, consumption, uterine and nervous diseases are observed in greater proportion amongst the factory workers, while ordinary bronchitis, bowel affection, gastric disease, and dropsy were in a diminished ratio.

It may be well to mention as explanation, that none but the most severe cases have been for a long time admissible into the general hospital, which would account for the very small ratio in

the gastric, nervous, and uterine diseases. As fever cases, except among a paying class, are not admitted at all, I have accordingly not taken them into consideration.

3. The returns which I collected from the six dispensary districts, between the years 1852 and 1855, produced a total of 2503 mill-workers affected by disease; of these, 394 were males, and 2109 females: the proportion of disease is seen in the following table:—

| | Per Cent. | | Per Cent. |
|------------------------|-----------|--------------------------------|-----------|
| Of the chest | 18·783 | Of the Locomotive organs | 4·983 |
| Gastric ailments | 14·816 | Injuries | 2·009 |
| Skin | 13·009 | Phthisis | 2·116 |
| Bowels | 12·005 | Nervous affection | 1·073 |
| Fevers | 11·095 | Dropsy | ·096 |
| Uterine diseases | 9·056 | Headache | ·009 |
| Syphilis | 5·026 | | |

Comparing these results with those drawn from an average of two years, on a base of 35,039 cases of all diseases as they occurred in the dispensary districts, we find the following differences:—

| | |
|--|------------------|
| Fever was more among the mill-workers by 3·15 in comparison with the general labouring population. | |
| Syphilis increased by | 1·0061 per cent. |
| Diseases of the chest | 6·0093 „ |
| Gastric ailments | 8·0116 „ |
| Uterine diseases | 2·0683 „ |
| Locomotive organs | 1·0633 „ |
| Phthisis | 1·3116 „ |

On the other hand, disease was *less* amongst the mill-workers, in the following proportions:—

| | | | |
|--------------------------|----------------|---------------------------|---------------|
| Skin diseases, by | 4·05 per cent. | Injuries, by | ·06 per cent. |
| Bowel affections, by ... | 8·64 „ | Nervous diseases, by | ·22 „ |
| Dropsical „ by | ·02 „ | | |

Of the entire 2,503 workers, I have separated the hacklers, and to these have added those from hospital returns for a number of years, making in all but 65, a number perhaps too small upon which to *base* any result were it not for its conclusiveness.

| | |
|---|--------|
| Thus, of chest diseases we find the high proportion of 30·7 per cent. | |
| Of the skin | 15·3 „ |
| Of the locomotive organs | 15·3 „ |
| Of the bowels affection | 12·3 „ |
| Of Phthisis | 3·0 „ |
| Syphilis | 3·0 „ |
| The other affections each under 2 per cent. | |

The marked preponderance of pulmonary affections, though not of phthisis, evidenced by this table, is a fact of *striking* importance, and realizes the *à priori* impression to which I have already referred.

It will appear, from a careful reflection upon the foregoing results, that although conclusions, as drawn from the different sources, are not uniformly concurrent in every particular, still the weight of evidence is in favour of the existence of a considerable amount of ailment (23 per cent. even of those actually at work), and a marked

proportionate increase in some particular diseases to which the mill-worker seems more especially liable; for instance, pulmonary disease, generally bronchitis, is *par excellence*, the hackler's malady. The young workers in the spinning rooms, complain more particularly of articular affections, the elder, of headaches, debility, dyspepsia, phthisis, uterine and pulmonary diseases. These facts are, then, borne out not merely by what we should expect from the nature of the employment, but also from actual experience. This being so, we shall conclude this paper by pointing out some means which may be calculated to reduce disease to a minimum, and improve the comfort and condition of the operative.

1. I would recommend increased provision for insuring full ventilation of the different apartments. I am quite aware that the factories more recently erected exhibit a great improvement in this important requisite, when compared with the establishments of an earlier date. But though we may notice more spacious rooms, less crowding of the machines, and a better adjustment of the window-sashes, still, with rare exceptions, we do not find that there is any adequate provision for maintaining free interchange of the atmosphere under all circumstances. It is quite common for the operatives themselves to regulate the opening of the sashes, or ventilating panes, agreeably to their own feelings of heat or cold, and without any reference to the real average temperature of the department, or the real amount of air space which should be enjoyed by each. Now I would suggest that means be adopted in every factory to ensure an equal temperature, and the freest change of atmosphere, without being subject to the control or whim of the operative. What the precise plans should be to realize this provision, architects should be in a better position to state; but I may here suggest that, in addition to lofty ceilings and abundance of windows, there should be shafts, horizontal and perforated, traversing the ceilings in different directions, and all communicating with a large fan connected with the driving-wheel, which would act by drawing out the used air and expelling it outside the walls. In some rooms, as the hackling and carding apartments, it would be, perhaps, necessary to supplement this method by providing a perforated floor, communicating with a chamber a few inches in depth, but extending the entire area of the floors. This arrangement would allow of a free in-going current, to compensate for the out-going drain of the used or contaminated air. I am aware that in some establishments this arrangement has been partially carried out. Thus, at Leeds, in the Messrs. Marshall's mill, I noticed the fan applied for the withdrawal of the foul air of the hackling-rooms; but in this instance, the air impregnated with the flax dust, was sucked out by chambers ranged along the floor of the apartment—a method which I cannot think to be so efficacious as the system suggested.

Again, I am of opinion, that some uniform arrangement might be easily made, whereby the opening of the sashes, when required, should be regulated *en masse*, and not, as at present, individually, and at the discretion of the operative, or overseer, whereby draughts and minor currents are produced, injurious to more or fewer of the workers in the line of such currents. I can readily conceive of the

realization of some such mechanical design as would effect the end desired, in connection with, say the rise and fall, of the thermometer.

2. The inhalation of the flax and tow dust, which I have shown to be so pernicious, is still going on in our newest and most improved factories unchecked. Some means to prevent the entrance of the injurious particles into the respiratory passages, is imperatively required. Professor Alison, whose recent indisposition all true friends of science must deeply regret, encouraged the workers in stone to grow moustaches, with a view to effect this object; and were all carders and hacklers of suitable age, such a course might be advantageously adopted, but, unfortunately, the most numerous portion in this department comprise mere boys. Taking up the natural hint, however, there can be no reason for supposing that some artificial respirator or contrivance, to act as the natural appendage, might not be of the highest benefit. In realizing this arrangement, it would be necessary to bear in mind that the freest respiration must be maintained, and that the least impediment in this direction, must be scrupulously guarded against. I am not prepared to say what particular form of material, or kind of adjustment, would be requisite; but most certainly the ordinary respirators in use by pulmonary invalids would be quite ineffectual for the purpose. In the absence of anything like a neutralizing agent, some such contrivance as I have alluded to, seems indispensable to nullify the admitted injurious effects of the flax and tow dust.

3. As to the evils of the spinning department, though a high temperature and a moist atmosphere are indispensable to the carrying on of the manufacture, I am of opinion, something of effectual aid might still be considered an open question. It is well known that the workers leave the mill three times a day in moist clothes and with a perspiring skin, and pass immediately into an atmosphere frequently the very opposite. The transition is sudden, and from its very suddenness must be exceedingly trying to any constitution, and much more so to that of the young female. Again, all the workers in every department, must carry away with them more or less of the refuse, and dust, and dirt necessarily attendant on their employment; and hence is insured an almost constant disregard of that most necessary requisite for the maintenance of health, cleanliness. This is a fact almost universal, as I have myself, hundreds of times, had opportunities of verifying. With a view, then, to mitigate, if not altogether counteract, the injury consequent upon these practices, I would desire to see provision for a change of garments (at least in part), the use of a suitable mill-dress while at work, and the resumption of their usual outer clothing on leaving. During work, the ordinary clothes should be hung up in a dry room heated a little above the out-door temperature. By means such as this, the greatest amount of comfort would be enjoyed by the operative consistent with her employment, and the utmost amount of prevention of injurious consequences adopted. I may here suggest, as an additional advantage, that the work-dresses might be provided with waterproof front facings or aprons, to prevent the dresses becoming saturated with the spray from the machinery. And, at the close of the evening work, it would be most desirable if employers would

provide the means of bathing or washing of the body on the premises, so that the workers might be at once prepared to enjoy themselves in suitable recreation, mental or bodily.

And this remark leads me, in closing this paper, to offer a word of entreaty to factory employers, regarding their duty and interest in encouraging, I do not say affording, all proper means of enabling the operative to spend their evenings in a manner calculated to improve their mental condition, and render them more disposed to give freely and fully a good day's work for a fair day's wages. I allude especially to the encouragement of musical societies, and reading clubs, amongst the workers. I deem such of incalculable advantage, not merely to the operative in refining his tastes, and thereby giving him a counteracting power against the degrading though seductive attractions of vicious habits, but to the employer who receives the benefit with interest in the better fulfilment of the operative's duty, and the greater degree of confidence which becomes established between them. I feel assured that nothing can be nearer the truth, than that such a course as I have hinted at would ensure that willingness and disposition to improve amongst the workers, which the highest wages would singly be insufficient to command. I recommend it with all respect, yet earnestly, knowing that many have found themselves in the responsible position of employers, without being at all impressed with the importance of the good old adage, that "property has its duties, as well as its rights"—without, in fact, being fully aware of the momentous relations which they have thereby established.
